

AMENDMENTS TO THE CLAIMS

The text of all pending claims, including withdrawn claims, is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strike through~~. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered).

Please AMEND claim 25 and ADD new claims 63-69 in accordance with the following:

1-24. (Cancelled)

25. (Currently Amended) An apparatus for detecting the heart rate of a fetus, the apparatus comprising:

a detector to detect heart beats of the fetus, the detector including at least two electrodes placed on the abdomen of the mother for detecting ECG signals; and

a processor, coupled to the detector, ~~to process~~ adapted to determine the heart rate of the fetus by only processing the ECG signals received from the at least two electrodes ~~to determine the heart rate of the fetus and without using any other detected signals~~, the processor including

means for detecting heart beats of the mother by determining when the ECG signals reach a maximum, and

means for determining the heart rate of the mother by determining the time interval between adjacent heart beats, so as to determine the heart rate of the mother using only the processed ECG signals.

26. (Previously Presented) An apparatus according to claim 25, comprising:
at least two detectors to detect heart beats of the fetus, each detector including at least two electrodes to detect ECG signals, the detectors being positioned on the abdomen of the mother in use, and the processor being adapted to process the ECG signals received from each detector and determine the heart rate of the fetus.

27. (Previously Presented) An apparatus according to claim 26, wherein a common electrode forms one of the electrodes of each detector.

28. (Previously Presented) An apparatus according to claim 26, wherein the

processor generates virtual ECG signals as a weighted sum of the ECG signals detected by the detectors, the virtual ECG signals representing the ECG signals that would have been obtained from a virtual detector positioned at a virtual location on the abdomen of the mother.

29. (Previously Presented) An apparatus according to claim 28, wherein each virtual ECG signal is generated dynamically so as to represent the ECG signals that would be received from a detector dynamically located on the mother's abdomen.

30. (Previously Presented) An apparatus according to claim 25, the apparatus further comprising a signal processor to amplify and filter the ECG signals detected by the detectors.

31. (Previously Presented) An apparatus according to claim 25, the apparatus further comprising an output to display an ECG trace of the heart beat of the fetus in accordance with the detected ECG signals.

32. (Previously Presented) An apparatus according to claim 25, wherein the processor includes a filter to filter the ECG signals from the detector so as to reduce noise.

33. (Previously Presented) An apparatus according to claim 32, wherein the processor correlates a maternal template with the filtered ECG signal to identify the temporal positions of maternal heart beats.

34. (Previously Presented) An apparatus according to claim 33, wherein the processor subtracts the maternal template from the filtered ECG signal at the said temporal positions of the maternal heart beats to generate a fetal ECG exhibiting fetal heart beats but without exhibiting maternal heart beats.

35. (Previously Presented) An apparatus according to claim 34, wherein the processor correlates the fetal ECG with a fetal template in order to enhance the fetal heart beat portions of the fetal ECG.

36. (Previously Presented) An apparatus according to claim 34, wherein the processor includes a bandpass filter to filter the fetal ECG to enhance the fetal heart beat portions of the fetal ECG.

37. (Previously Presented) An apparatus according to claim 36, wherein the bandpass filter has a pass band of 25-40 Hz.

38. (Previously Presented) An apparatus according to claim 35, wherein the processor is adapted to identify fetal heart beats by detecting maxima of the correlated fetal ECG.

39. (Previously Presented) An apparatus according to claim 36, wherein the processor is adapted to identify fetal heart beats by detecting maxima of the filtered fetal ECG.

40. (Previously Presented) An apparatus according to claim 33, wherein the processor is adapted to determine the heart rate of the fetus from the ECG signals by:
suppressing portions of the ECG signals representative of the heart beat of the mother;
detecting heart beats of the fetus by determining when the remaining ECG signal reaches a maximum; and
determining the heart rate by determining the time interval between adjacent heart beats.

41. (Previously Presented) An apparatus according to claim 25, wherein the processor is further adapted to aggregate the obtained heart rates over a predetermined time period of not less than one hour.

42. (Previously Presented) An apparatus according to claim 25, wherein the apparatus is portable.

43. (Previously Presented) An apparatus according to claim 25, wherein the processor is adapted to determine the standard deviation of each time interval between the heart beats detected, and select the time intervals having a standard deviation lower than a predetermined value, so as to determine the heart rate in accordance with the time interval between adjacent heart beats.

44. (Previously Presented) An apparatus according to claim 43, wherein the predetermined value is approximately 7 ms for four consecutive time intervals.

45. (Previously Presented) An apparatus according to claim 43, wherein the processor is adapted to
designate time intervals not selected to be erroneous time intervals; and
modify the erroneous time intervals in accordance with the selected time intervals.

46. (Previously Presented) An apparatus according to claim 45, wherein to modify the time intervals comprises:
comparing the erroneous time interval to the selected time intervals;
determining the number of errors within the erroneous time interval;
identifying possible fetal heart beats within the erroneous time intervals; and
determining the true fetal heart beat from the possible fetal heart beats, based upon the signature of the fetal heart beat.

47. (Previously Presented) An apparatus according to claim 46, the processor being further adapted to average the time intervals and the corrected time intervals to determine a heart rate.

48-62. (Cancelled)

63. (New) An apparatus for detecting the heart rate of a fetus, the apparatus comprising:
a detector to detect heart beats of the fetus, the detector including at least two electrodes placed on the abdomen of the mother for detecting ECG signals;
a processor, coupled to the detector, adapted to determine the heart rate of the fetus by only processing the ECG signals received from the at least two electrodes, the processor including

means for detecting heart beats of the mother by determining when the ECG signals reach a maximum, and

means for determining the heart rate of the mother by determining the time interval between adjacent heart beats, so as to determine the heart rate of the mother using only the processed ECG signals; and

at least two detectors to detect heart beats of the fetus, each detector including at least two electrodes to detect ECG signals, the detectors being positioned on the abdomen of the mother in use, and the processor being adapted to process the ECG signals received from each

detector and determine the heart rate of the fetus,

wherein the processor generates virtual ECG signals as a weighted sum of the ECG signals detected by the detectors, the virtual ECG signals representing the ECG signals that would have been obtained from a virtual detector positioned at a virtual location on the abdomen of the mother.

64. (New) An apparatus according to claim 28, wherein each virtual ECG signal is generated dynamically so as to represent the ECG signals that would be received from a detector dynamically located on the mother's abdomen.

65. (New) An apparatus for detecting the heart rate of a fetus, the apparatus comprising:

a detector to detect heart beats of the fetus, the detector including at least two electrodes placed on the abdomen of the mother for detecting ECG signals; and

a processor, coupled to the detector, adapted to determine the heart rate of the fetus by only processing the ECG signals received from the at least two electrodes, the processor including

means for detecting heart beats of the mother by determining when the ECG signals reach a maximum, and

means for determining the heart rate of the mother by determining the time interval between adjacent heart beats, so as to determine the heart rate of the mother using only the processed ECG signals,

wherein the processor is adapted to determine the standard deviation of each time interval between the heart beats detected, and select the time intervals having a standard deviation lower than a predetermined value, so as to determine the heart rate in accordance with the time interval between adjacent heart beats.

66. (New) An apparatus according to claim 65, wherein the predetermined value is approximately 7 ms for four consecutive time intervals.

67. (New) An apparatus according to claim 65, wherein the processor is adapted to designate time intervals not selected to be erroneous time intervals; and modify the erroneous time intervals in accordance with the selected time intervals.

68. (New) An apparatus according to claim 67, wherein to modify the time intervals comprises:

- comparing the erroneous time interval to the selected time intervals;
- determining the number of errors within the erroneous time interval;
- identifying possible fetal heart beats within the erroneous time intervals; and
- determining the true fetal heart beat from the possible fetal heart beats, based upon the signature of the fetal heart beat.

69. (New) An apparatus according to claim 68, the processor being further adapted to average the time intervals and the corrected time intervals to determine a heart rate.